CLAIMS

What is claimed is:

Sub a2 1. An optical switch for a network having a plurality of nodes, comprising:

1) a switch coupled to communications links used for input and output in which a plurality of wavelengths are used to carry traffic on a communications link; and

2) a controller, coupled to the switch, for controlling the operation of the switch by implementing a routing protocol, and implementing a labeling protocol to associate a wavelength with a route table destination,

the controller controlling the switch to direct the various wavelengths of traffic from an input link to an appropriate output link as determined by the routing protocol and the labeling protocol.

Sub b2 2. The optical switch according to claim 1, further comprising a route table for storing destinations therein for routing of said traffic,

wherein different destinations stored in the route table are associated with different wavelengths of light.

3. The optical switch according to claim 2, further comprising ~~a reflective~~ device for directing ~~traffic from said~~ input link to an appropriate output link.

4. The optical switch according to claim 3, wherein said reflective device comprises a mirror.

Sub B3 5. The optical switch according to claim 1, wherein said ~~switch comprises~~ a light beam steering ~~mechanism~~ for directing traffic from said input link to an appropriate ~~output link.~~

6. The optical switch according to claim 2, wherein said switch uses a same wavelength on both said input link and said output link when it directs traffic from an input link to an output link.

5. 7. The optical switch according to claim 3, wherein said switch uses a same wavelength on both said input link and said output link when it directs traffic from an input link to an output link .

8. The optical switch according to claim 1, wherein, in said network, routes for a destination form a tree, and

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wherein said switch establishes switched paths to each egress point at which traffic leaves a network of ones of said switch, the switched paths to said egress being used for all destinations that are behind said egress.

9. The optical switch according to claim 8, wherein the switched paths are established from each said egress, by growing a switched path tree which is rooted at the egress.

10. The optical switch according to claim 9, wherein a selected path tree uses a single wavelength that is passed upwards from a root as branches are added to the selected path tree.

11. The optical switch according to claim 10, wherein different shades of a same wavelength are employed at a merge point of light beams of said traffic.

12. The optical switch according to claim 10, wherein a plurality of switches exist in said network, and

wherein multi-fiber bundles are used on links between optical switches employed in said network such that the same wavelengths from different sources are carried on different fibers in a bundle.

13. The optical switch according to claim 10, further comprising:

a plurality of optical ports connectable to said switch, each port connecting to a plurality of bundles of optical fibers, wherein a port receives traffic on a first of said fiber bundles and transmits on a second of said fiber bundles,

each fiber bundle containing one optical fiber or a plurality of optical fibers, each for carrying a plurality of said wavelengths of light.

Sub B4 > 14. The optical switch according to claim 13, wherein, in a network of ~~ones of said~~ switch, a wavelength is associated ~~with each~~ egress and a selected fiber number is ~~associated with~~ each ingress point.

24. ~~15.~~ 23 The optical switch according to claim ~~14~~, wherein a unique number is assigned to each node and the *i*-th color will be used for traffic that leaves the network at node *i* and the *i*-th fiber for traffic that enters the network at node *i*.

25. ~~16.~~ 24 The optical switch according to claim ~~15~~, wherein a fiber *i* is only used for traffic originating at a node *i* and node *i*'s traffic arrives at any node *j* on a single port, to avoid a merging problem on fiber *i*.

26. ~~17.~~ 23 The optical switch according to claim ~~14~~, wherein said switch includes a wavelength separator for separating wavelengths in the fibers of the bundle, thereby

to produce a two-dimensional array of light beams in which a first dimension corresponds to color and a second dimension corresponds to fiber number.

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~~18~~. The optical switch according to claim ~~17~~, wherein said switch further comprises a plurality of mirrors for reflecting said light beams.

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~~19~~. The optical switch according to claim ~~18~~, wherein a predetermined color corresponds to a predetermined egress and all the predetermined color light beams are arranged in a column, such that said mirror steers the column of predetermined color light beams to a selected output port.

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~~20~~. The optical switch according to claim 1, wherein said data path through the switch is devoid of electronic components.

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~~21~~. The optical switch according to claim 13, wherein a group of said wavelengths is associated with said egress point.

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22. The optical switch according to claim 13, wherein said switch ~~further comprises a~~ light steering mechanism,

wherein, with said fiber bundle containing one optical fiber, said light steering mechanism steers blocks of predetermined numbers of wavelengths to selected output ports.

23. The optical switch according to claim 13, wherein said switch further comprises a light steering mechanism,

wherein, with said fiber bundle including a plurality of optical fibers, said switch merges the fibers from the input ports, such that a fiber-0 is merged from each of the input ports into a single merged fiber-0 and doing the same for each of the other plurality of fibers.

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~~24~~. The optical switch according to claim ~~23~~, wherein said light steering mechanism steers individual wavelengths of said plurality of wavelengths to selected output ports.

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~~25~~. The optical switch according to claim ~~23~~, wherein said light steering mechanism steers blocks of predetermined numbers of wavelengths to selected output ports.

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~~26~~. The optical switch according to claim ~~23~~, wherein wavelengths in resulting merged fibers are separated into blocks of a predetermined number of wavelengths, to form a two-dimensional array of light beams where a first dimension comprises a fiber number and a second dimension corresponds to a block of wavelengths.

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27. The optical switch according to claim 5, wherein said light beam ~~steering~~ ~~mechanism~~ comprises a non- movable mirror formed of a liquid crystal.

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28. The optical switch according to claim ~~27~~, wherein said switch further comprises a voltage source for applying a voltage to said liquid crystal to change a transparent state of said liquid crystal to a reflective state, thereby steering a light beam to a particular output port by applying a voltage to a selected liquid crystal.

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29. The optical switch according to claim 1, wherein said network comprises one of the Internet, a local area network (LAN), a wide area network (WAN), and a point-to-point link between two systems.

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30. The optical switch according to claim 1, wherein said labeling protocol comprises one of multiprotocol label switching (MPLS), aggregate route-based Internet switching (ARIS), and tag switching.

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31. An optical switch for a network having a plurality of nodes, ~~comprising~~:

1) a switch coupled to communication links used for input and output in which a plurality of wavelengths are used to carry traffic on a communications link; and

2) a controller, coupled to said switch, for controlling an operation of said switch by implementing a routing protocol and exchanging routing information with other nodes, implementing a network protocol and forwarding said traffic to a next hop, and implementing a labeling protocol to associate a label with a route table destination,

the controller controlling said switch such that said switch uses said wavelengths of said link to route said traffic between said nodes of said network.

32. A network, comprising:

a plurality of nodes for communicating with one another; and

a plurality of optical switches for routing traffic between said nodes, each of said optical switches comprising:

1) a switch coupled to communications links used for input and output in which a plurality of wavelengths are used to carry traffic on a communications link; and

2) a controller, coupled to the switch, for controlling an operation of the switch by implementing a routing protocol, and implementing a labeling protocol to associate a wavelength with a route table destination,

the controller controlling said switch to direct various wavelengths of traffic from an input link to an appropriate output link as determined by the routing protocol and the labeling protocol.

33. A network, comprising:

a plurality of nodes for communicating with one another; and

a plurality of optical switches for routing traffic between said nodes, each of said optical switches comprising:

1) a switch coupled to communications links used for input and output in which a plurality of wavelengths are used to carry traffic on a communications link; and

2) a controller, coupled to said switch, for controlling an operation of said switch by implementing a routing protocol and exchanging routing information with other nodes, implementing a network protocol and forwarding said traffic to a next hop, and implementing a labeling protocol to associate a label with a route table destination,

the controller controlling said switch such that said switch uses said wavelengths of said link to route said traffic between said nodes of said network.

34. A method of communicating over a network having a plurality of nodes, comprising:

1) coupling a switch to communications links used for input and output in which a plurality of wavelengths are used to carry traffic on a communications link; and

2) controlling an operation of the switch by implementing a routing protocol, and implementing a labeling protocol to associate a wavelength with a route table destination,

said controlling including directing various wavelengths of traffic from an input link to an appropriate output link as determined by the routing protocol and the labeling protocol.

35. A method of communicating over a network having a plurality of nodes, comprising:

1) coupling a switch to communications links used for input and output in which a plurality of wavelengths are used to carry traffic on a communications link; and

2) controlling an operation of said switch by implementing a routing protocol and exchanging routing information with other nodes, implementing a network protocol and forwarding said traffic to a next hop, and implementing a labeling protocol to associate a label with a route table destination; and

using said wavelengths on said link to route said traffic between said nodes of said network.

36. A signal-bearing medium tangibly embodying a program of machine-readable instructions executable by a digital processing apparatus to perform a method of routing traffic over a network having a plurality of nodes, said method comprising:

causing a switch to be coupled to communications links used for input and output in which a plurality of wavelengths are used to carry traffic on a communications link; and

controlling the operation of an switch by implementing a routing protocol, and implementing a labeling protocol to associate a wavelength with a route table destination,

said controlling including directing the various wavelengths of traffic from an input link to an appropriate output link as determined by the routing protocol and the labeling protocol.

37. A signal-bearing medium tangibly embodying a program of machine-readable instructions executable by a digital processing apparatus to perform a method of routing traffic over a network having a plurality of nodes, said method comprising:

causing a switch to be coupled to communications links used for input and output in which a plurality of wavelengths are used to carry traffic on a communications link; and

controlling an operation of said switch by implementing a routing protocol and exchanging routing information with other nodes, implementing an network

protocol and forwarding said traffic to a next hop, and implementing a labeling protocol to associate a label with a route table destination; and

using said wavelengths of said link to route said traffic between said nodes of said network.

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